

CLAIMS

1. An artificial bone forming method by a powder lamination method, comprising:

5 a) a powder layer forming step for forming, a powder bone material having biocompatibility and hardening by hydration, into a flat powder layer,

10 b) a partial hardening step for jetting an aqueous solution with biocompatibility to a part of the powder

layer to harden a jettied portion by hydration, and

15 c) an artificial bone forming step for repeating the steps a) and b) for lamination to form a specified artificial bone of a predetermined three-dimensional structure in which the hardened portions are connected to each other.

2. The artificial bone forming method by the powder lamination method according to claim 1, wherein

20 the powder bone material is constituted of an inorganic component such as calcium phosphate and other bone components, and

25 the aqueous solution is a liquid mixture or a suspension of water and a water-soluble biopolymer which is a component derived from a living organism.

3. The artificial bone forming method by the powder lamination method according to claim 1, wherein

the powder bone material is a calcium salt such as calcium phosphate, hydroxyapatite, human bone, animal bone, alumina, collagen, polylactic acid, a copolymer of polylactic acid and polyglycolic acid, or a mixture thereof.

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4. The artificial bone forming method by the powder lamination method according to claim 1, wherein the aqueous solution is a liquid mixture or a suspension of water and soluble collagen, proteoglucon, linkprotein, sodium tartrate, a pH adjuster, a bone growth factor, fibrin, PRP (Platelet-Rich Plasma), a polysaccharide, an amino acid polymer, polylactic acid, a copolymer of polylactic acid and polyglycolic acid, or a mixture thereof.

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5. The artificial bone forming method by the powder lamination method according to claim 4, wherein two or more kinds of liquid mixtures which react with each other in a liquid layer to bring about a hardening reaction are put in separate vessels, and they are jetted through a plurality of ink jet nozzles so as to be mixed and hardened at a jetting portion.

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6. The artificial bone forming method by the powder lamination method according to claim 4, wherein a component which further promotes a crosslinking reaction or polymerization of a polymeric component of the

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artificial bone is put in a vessel different from a vessel for a living material to be reacted or polymerized, and the component is jetted through another ink jet nozzle to be mixed at an intended position.

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7. The artificial bone forming method by the powder lamination method according to claim 1, further comprising d) an artificial bone reinforcing step for discharging a gas contained in the artificial bone to further reinforce the hardened portions by a reaction by using a change in pressure, after the step c).

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15 8. The artificial bone forming method by the powder lamination method according to claim 1 or 7, wherein a hardening reaction is promoted for the formed artificial bone after the artificial bone reinforcing step or the step c) directly under high-temperature and high-pressure water vapor or under a dry high temperature in an autoclave.

20 9. An artificial bone forming method by a powder lamination method, comprising:

carrying out a high-temperature heat treatment in a vacuum state or an oxygen-free atmosphere to induce a reaction between biopolymers of an artificial bone formed by mixing the biopolymers, a reaction with other components, or melting.

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10. An artificial bone forming method by a powder lamination method, comprising:

a) a two-dimensional data creating step for sequentially moving a target bone in a predetermined direction to create two-dimensional data of a cut section,

5 b) a tissue data processing step for creating data to be subjected to rapid prototyping for a plurality of tissues constituting a bone from the two-dimensional data, and

10 c) an artificial bone forming step for forming an artificial bone constituted of a plurality of tissue structures by using a rapid prototyping device.

11. The artificial bone forming method by the powder lamination method according to claim 10, wherein the tissue data is constituted of a plurality of data selected from a cancellous bone, a bone trabecula, a lumen, and a cortical bone.